WHAT IS CLAIMED IS:

1. A wavelength router for receiving, at an input port, light having a plurality of spectral bands and directing subsets of said spectral bands to respective ones of a plurality of output ports, the wavelength router comprising:

a free-space optical train disposed between the input ports and said output ports providing optical paths for routing the spectral bands, the optical train including a dispersive element disposed to intercept light traveling from the input port, said optical train being configured so that light encounters said dispersive element twice before reaching any of the output ports; and

a routing mechanism having at least one dynamically configurable routing element to direct a given spectral band to different output ports, depending on a state of said dynamically configurable element.

2. The wavelength router of claim 1 wherein said input port is located at the end of an input fiber.

3. The wavelength router of claim 1 wherein said output ports are located at respective ends of a plurality of output fibers.

4. The wavelength router of claim 1 wherein said routing mechanism has a configuration that directs at least two spectral bands to a single output port.

5. The wavelength router of claim 1 wherein said routing mechanism has a configuration that results in at least one output port receiving no spectral bands.

6. The wavelength router of claim 1 wherein the number of spectral bands is greater than the number of output ports, and the number of output ports is greater than 2.

7. The wavelength router of claim 1 wherein said routing mechanism includes a plurality of reflecting elements, each associated with a respective one of the spectral bands.

9. The wavelength router of claim 1 wherein said dynamically configurable element has a rotational degree of freedom.

10. The wavelength router of claim 1 wherein:

said dispersion element is a grating; and

said optical train includes optical power incorporated into said grating.

11. The wavelength router of claim 1 wherein:

said optical train includes a lens;

said dispersive element is a reflection grating;

said routing mechanism includes a plurality of dynamically configurable elements;

light coming from said input port is collimated by said lens and is reflected from said reflection grating as a plurality of angularly separated beams corresponding to said spectral bands;

said angularly separated beams are focused by said lens on respective ones of said dynamically configurable elements; and

each given dynamically configurable element has a plurality of states, each adapted to direct that dynamically configurable element's respective angularly separated beam along a desired one of a plurality of paths such that light leaving that dynamically configurable element is again collimated by said lens, reflected by said reflection grating, and again focused by said lens on one of said output ports corresponding to the desired one of said plurality of paths.

12. A wavelength router for receiving light having a first number, N, of spectral bands at an input port and directing subsets of said N spectral bands to respective ones of a second number, M, of output ports, the wavelength router comprising:

a free-space optical train disposed between the input ports and said output ports providing optical paths for routing the spectral bands, the optical train including a dispersive element disposed to intercept light traveling from the input port, said optical train being configured so that light encounters said [illegible] element twice before reaching

13. The wavelength router of claim 12 wherein said dispersive element is a reflection grating, and the optical train includes:

a lens disposed to intercept light from the input port, collimate the intercepted light, direct the collimated light toward said reflection grating, intercept light reflected from the reflection grating, focus the light, and direct the focused light along a path, with each spectral band being focused at a different point; and

a plurality of N reflecting elements disposed to intercept respective focused spectral bands and direct the same so as to encounter said lens, said reflection grating, said lens, and respective output ports.

14. The wavelength router of claim 12 wherein said dispersive element is a transmission grating, and the optical train includes:

a lens disposed between said transmission grating and the input port; and

a plurality of N reflecting elements on a side of said transmission grating that is remote from said input port so as to cause light passing through said grating and falling on said reflecting elements to pass through said transmission grating, said lens and said the output ports.

15. The wavelength router of claim 12 wherein said dispersive element is a reflection grating, and the optical train includes:

a curved reflector disposed to intercept light from the input port, collimate the intercepted light, direct the collimated light toward said reflection grating, intercept light reflected from the reflection grating, focus the light, and direct the focused light along a path, with each spectral band being focused at a different point; and

a plurality of N reflecting elements disposed to intercept respective focused spectral bands and direct the same so as to encounter said curved reflector, said reflection grating, said curved reflector, and respective output ports.

16. The wavelength router of claim 12 wherein said dispersive element is a prism.

18. A wavelength router for receiving light having a first number, N, of spectral bands at an input port and directing subsets of said N spectral bands to respective ones of a second number, M, of output ports, the wavelength router comprising:

a first cylindrical lens for collimating light emanating from the input port in a first transverse dimension;

a second cylindrical lens for collimating the light in a second transverse dimension that is orthogonal to said first transverse dimension;

a transmissive dispersive element for dispersing the light in said first transverse dimension in a particular sense;

a third cylindrical lens for focusing the light in the first transverse dimension;

a plurality of N tiltable mirrors in the focal plane of said third cylindrical lens, each intercepting a respective spectral band and directing that spectral band back toward said third cylindrical lens; and

a plurality of actuators, each coupled to a respective mirror to effect selective tilting of the light path of the respective spectral band;

wherein each spectral band is collimated in the first transverse dimension by said third cylindrical lens, dispersed in the first transverse dimension by the grating in a sense opposite the particular sense, focused in the second transverse dimension by said second cylindrical lens and focused in the first transverse dimension by said first cylindrical lens, whereupon each spectral band is brought to a focus in both the first and second transverse dimensions at a respective position determined by the respective tiltable mirror.

19. The wavelength router of claim 18, and further comprising an array of output fibers positioned to receive light from said return path, whose positions correspond to the tilts of said plurality of tiltable mirrors in a Fourier relationship through said second cylindrical lens.

20. The wavelength router of claim 18 wherein said mirrors are made

21. A wavelength router for receiving light having a first number, N, of spectral bands at an input port and directing subsets of said N spectral bands to respective ones of a second number, M, of output ports, the wavelength router comprising:

a first spherical lens for collimating light emanating from the input port;

a transmissive dispersive element for dispersing the light in a first transverse dimension in a particular sense to spatially separate the spectral bands;

a second spherical lens for focusing the light traveling from said dispersive element; and

a plurality of retroreflectors in the focal plane of said second spherical lens, each retroreflector intercepting a respective spectral band and directing that spectral band back toward said second spherical lens with a transverse displacement in a second transverse dimension that is orthogonal to the first transverse dimension, said transverse displacement depending on a state of that retroreflector;

wherein each spectral band is collimated by said second spherical lens, dispersed in the first transverse dimension by the grating in a sense opposite the particular sense, focused by said first spherical lens, whereupon each spectral band is brought to a focus at a respective position determined by the respective retroreflector.

22. A wavelength router for receiving light having a first number, N, of spectral bands at an input port and directing subsets of said N spectral bands to respective ones of a second number, M, of output ports, the wavelength router comprising:

an optical element with positive optical power disposed to collimate light emanating from the input port;

a reflective dispersive element for dispersing the light traveling from said optical element in a first transverse dimension in a particular sense to spatially separate the spectral bands, said dispersive element directing the spectral bands back to said optical element, which focuses the light traveling from said dispersive element; and

a plurality of retroreflectors in the focal plane of said optical element, each retroreflector intercepting a respective spectral band and directing that spectral band back toward said optical element with a transverse displacement in a second transverse

wherein each spectral band is collimated by said optical element, dispersed in the first transverse dimension by said dispersive element in a sense opposite the particular sense, focused by said optical element, whereupon each spectral band is brought to a focus at a respective position determined by the respective retroreflector.

23. The wavelength router of claim 22 wherein said optical element is a spherical lens.

24. The wavelength router of claim 22 wherein said optical element is a concave reflector.

25. The wavelength router of claim 22 wherein:

each retroreflector includes a rooftop prism; and

the state of that retroreflector is defined by a transverse position of that retroreflector's rooftop prism.

26. The wavelength router of claim 22 wherein:

each retroreflector includes a rooftop prism and a relatively movable associated body of transparent material configured for optical contact with that retroreflector's rooftop prism; and

the state of that retroreflector is defined at least in part by whether that retroreflector's rooftop prism is in optical contact with its associated body.

27. A method of making an array of rooftop prisms, the method comprising:

providing an elongate prism element;

providing a pair of elongate stop elements that have surfaces possessing a desired degree of flatness;

optically polishing surfaces of the elongate prism element to a desired degree of flatness;

subjecting the elongate prism element, thus optically polished, to a set of operations that provide the plurality of rooftop prisms that make up the array; and

28. The method of claim 27 wherein

the elongate prism element is a unitary component; and

the set of operations includes physically cutting the elongate prism element into individual prisms.

29. The method of claim 27 wherein:

the elongate prism element is a bonded component of individual prisms; and

the set of operations includes breaking the bonds between individual prism.

30. A dynamically configurable retroreflector comprising:

first and second flat mirrors, fixed at a particular included angle with respect to one another, said first and second flat mirrors defining an intersection axis;

a third flat mirror mounted for rotation about a rotation axis parallel to said intersection axis; and

an actuator coupled to said third flat mirror configured to provide first and second angular positions about said rotation axis, said first angular position being such to define an included angle of approximately 90° between said first and third flat mirrors, said second angular position being such to define an included angle of approximately 90° between said second and third flat mirrors.

31. A configurable retroreflector array comprising:

a support element having first and second mounting surfaces lying in planes defining an angle therebetween of approximately 90°.

first and second MEMS micromirror arrays disposed on respective first and second substrates, mounted to said first and second mounting surfaces of said support element;

a given micromirror in said first array being associated with a plurality of M micromirrors in said second array; and

an actuator coupled to each given micromirror in said first array to provide M discrete orientations of said given micromirror, each orientation directing light along

orientations such that each respective orientation [illegible]

the given mirror in said first array when the given mirror is oriented to direct light to that micromirror in said second array.

32. The configurable retroreflector array of claim 31 wherein:

said support element is a V-block having support surfaces facing toward each other; and

said first and second arrays are mounted with said first and second substrates disposed between the micromirrors in the arrays and said first and second mounting surfaces.

33. The configurable retroreflector array of claim 31 wherein:

said support element is a prism having support surfaces facing away from each other; and

said first and second arrays are mounted with the micromirrors in the arrays disposed between said first and second substrates and said first and second mounting surfaces.

34. The configurable retroreflector array of claim 31 wherein the micromirrors are limited to deflections on the order of $\pm 10°$.

35. A wavelength add-drop multiplexer comprising:.

first and second wavelength routers according to claim 1, connected in opposite directions with a first subset of the first wavelength router's output ports in optical communication with a corresponding first subset of the second wavelength router's output ports, said first wavelength router's input port being in optical communication with an upstream fiber, said second wavelength router's input port being in optical communication with downstream fiber, and respective second subsets of said first and second wavelength routers' output ports being in communication with network terminal equipment for receiving light from one of the second subsets of output ports and communicating light onto the other of the second subsets of output ports.

36. The wavelength router of claim 1 wherein said dispersive element is a grating having

WHAT IS CLAIMED IS:

1. An optical routing apparatus for directing an optical signal, the optical routing apparatus comprising:

(a) an input port configured to provide the optical signal;

(b) a plurality of output ports configured to receive the optical signal;

(c) a mirror; and

(d) a linear actuator disposed to move the mirror along an axis to a plurality of mirror positions, wherein in a first of such mirror positions the mirror is disposed such that the optical signal follows a first optical path from the input port to a first of the plurality of output ports, the first optical path including a reflection off the mirror.

2. The optical routing apparatus according to claim 1 wherein the plurality of output ports consists of two output ports.

3. The optical routing apparatus according to claim 1 wherein the mirror is disposed perpendicular to the axis.

4. The optical routing apparatus according to claim 3 further comprising a fixed reflective surface disposed such that the first optical path further includes a reflection off the fixed reflective surface.

5. The optical routing apparatus according to claim 4 wherein the fixed reflective surface is oriented perpendicular to the mirror.

6. The optical routing apparatus according to claim 4 wherein in a second of such mirror positions the mirror is disposed such that the optical signal follows a second optical path from the input port to a second of the plurality of output ports, the second optical path including a reflection off the mirror and off the fixed reflective surface.

7. The optical routing apparatus according to claim 1 wherein the

8. The optical routing apparatus according to claim 7 further comprising a first fixed reflective surface disposed such that the first optical path further includes a reflection off the first fixed reflective surface.

9. The optical routing apparatus according to claim 8 wherein the first fixed reflective surface is oriented perpendicular to the mirror.

10. The optical routing apparatus according to claim 8 further comprising a second fixed reflective surface,

wherein in a second of such mirror positions the mirror is disposed such that the optical signal follows a second optical path from the input port to a second of the plurality of output ports, the second optical path including a reflection off the second fixed reflective surface and off the first fixed reflective surface.

11. The optical apparatus according to claim 1 wherein the mirror is disposed at an angle between 40° and 50° to the axis.

12. An optical routing apparatus for directing a first optical signal and a second optical signal, the optical routing apparatus comprising:

(a) a first input port configured to provide the first optical signal;

(b) a second input port configured to provide the second optical signal;

(c) a first output port configured to receive one of the first and second optical signals;

(d) a second output port configured to receive one of the first and second optical signals;

(e) a primary mirror; and

(f) a primary linear actuator disposed to move the primary mirror along a primary axis to a plurality of primary mirror positions,

wherein in a first of such primary mirror positions the primary mirror is disposed such that the first optical signal follows a first optical path to the first output port and the second optical signal follows a second optical path to the second

mirror is disposed such that the first optical signal follows a third optical path to the

second output port and the second optical signal follows a fourth optical path to the first output port.

13. The optical routing apparatus according to claim 12 wherein the primary mirror is disposed parallel to the primary axis.

14. The optical routing apparatus according to claim 13 wherein the primary linear actuator lies in the path of the first optical signal in at least one of such first and second primary mirror positions.

15. The optical routing apparatus according to claim 14 wherein the primary linear actuator comprises a bore through which the first optical signal propagates when the primary mirror is positioned so that the primary linear actuator lies in the path of the first optical signal.

16 . The optical routing apparatus according to claim 14 wherein the primary linear actuator comprises an antireflective region transparent to a wavelength of the first optical signal, the region disposed such that the first optical signal propagates through the region when the primary mirror is positioned so that the primary linear actuator lies in the path of the first optical signal.

17. The optical routing apparatus according to claim 14 wherein the primary linear actuator is antireflective and transparent to a wavelength of the first optical signal.

18. The optical routing apparatus according to claim 13 wherein the primary mirror is reflective on two sides.

19. The optical routing apparatus according to claim 18 further comprising a first fixed reflective surface and a second fixed reflective surfaces, such first and second fixed reflective surfaces being disposed such that

the first optical path includes a reflection off a first reflective side of the primary mirror, two reflections off the first fixed reflective surface, and a reflection off the primary mirror and a reflection off the second fixed reflective surface.

the third optical path includes a reflection off the first fixed reflective surface and a reflection off the second fixed reflective surface, and

the fourth optical path includes a reflection off the first fixed reflective surface and a reflection off the second fixed reflective surface.

20. The optical routing apparatus according to claim 13 further comprising:

(g) a secondary mirror;

(h) a secondary linear actuator disposed to move the secondary mirror along a secondary axis to a plurality of secondary mirror positions;

(i) a tertiary mirror; and

(j) a tertiary linear actuator disposed to move the tertiary mirror along a tertiary axis to a plurality of tertiary mirror positions,

wherein in the first primary mirror position, the secondary mirror is disposed at a predetermined first secondary mirror position and the tertiary mirror is disposed at a predetermined first tertiary mirror position, and

wherein in the second primary mirror position, the secondary mirror is disposed at a predetermined second secondary mirror position and the tertiary mirror is disposed at a predetermined second tertiary mirror position.

21. The optical routing apparatus according to claim 20 wherein the secondary mirror is disposed parallel to the secondary axis and the tertiary mirror is disposed parallel to the tertiary axis.

22. The optical routing apparatus according to claim 21 wherein at least one of the primary, secondary, and tertiary linear actuators comprises a bore through which at least one of the first, second, third, and fourth optical signals propagates.

23. The optical routing apparatus according to claim 21 wherein at least one of the primary, secondary, and tertiary linear actuators comprises an antireflective region transparent to a wavelength of at least one of the first, second, third, and fourth optical signals and through which such at least one optical signal propagates.

transparent to a wavelength of at least one of the first, second, third, and fourth optical signals.

25. The optical routing apparatus according to claim 21 further comprising a first fixed reflective surface and a second fixed reflective surface, such first and second fixed reflective surfaces being disposed such that

the first optical path includes a reflection off the first fixed reflective surface and a reflection off the tertiary mirror,

the second optical path includes a reflection off the first fixed reflective surface and a reflection off the second fixed reflective surface,

the third optical path includes a reflection off the primary mirror and a reflection off the tertiary mirror, and

the fourth optical path includes a reflection off the first fixed reflective surface and a reflection off the secondary mirror.

26. The optical routing apparatus according to claim 20 wherein the secondary mirror is disposed perpendicular to the secondary axis.

27. The optical routing apparatus according to claim 26 wherein the primary linear actuator comprises a bore through which at least one of the first, second, third, and fourth optical signals propagates.

28. The optical routing apparatus according to claim 26 wherein the primary linear actuator comprises an antireflective region transparent to a wavelength of at least one of the first, second, third, and fourth optical signals and through which such at least one optical signal propagates.

29. The optical routing apparatus according to claim 26 wherein the primary linear actuator is antireflective and transparent to a wavelength of at least one of the first, second, third, and fourth optical signals.

30. The optical routing apparatus according to claim 26 wherein the [illegible]

comprising a fixed reflective surface disposed such that

the first optical path includes a reflection off the tertiary mirror and a reflection off the primary mirror,

the second optical path includes a reflection off the secondary mirror and a reflection off the fixed reflective surface,

the third optical path includes a reflection off the tertiary mirror and a reflection off the primary mirror, and

the fourth optical path includes a reflection off the secondary mirror and a reflection off the fixed reflective surface.

32. The optical apparatus according to claim 12 wherein the primary mirror is disposed at an angle between 40° and 50° to the primary axis.

33. A method for directing an optical signal, the method comprising:

(a) providing the optical signal from an input port; and

(b) reflecting the optical signal off a mirror that is configured for linear actuation along an axis to a plurality of mirror positions, wherein in a first of such mirror positions the mirror is disposed such that the optical signal follows a first optical path from the input port to a first of a plurality of output ports.

34. The method according to claim 33 wherein the plurality of output ports consists of two output ports.

35. The method according to claim 33 wherein the mirror is disposed perpendicular to the axis.

36. The method according to claim 35 further comprising reflecting the optical signal along the first optical path off a fixed reflective surface.

37. The method according to claim 36 wherein the fixed reflective surface is oriented perpendicular to the mirror.

38. The method according to claim 36 wherein in a second of such mirror positions the mirror is disposed such that the optical signal follows a second

39. The method according to claim 33 wherein the mirror is disposed parallel to the axis.

40. The method according to claim 39 further comprising reflecting the optical signal along the first optical path off a first fixed reflective surface.

41. The method according to claim 40 wherein the first fixed reflective surface is oriented perpendicular to the mirror.

42. The method according to claim 40 wherein in a second of such mirror positions the mirror is disposed such that the optical signal follows a second optical path from the input port to a secord of the plurality of output ports, the second optical path including a reflection off the second fixed reflective surface and off the first fixed reflective surface.

43. The method according to claim 33 wherein the mirror is disposed at an angle between 40° and 50° to the axis.

44. A method for directing a first optical signal and a second optical signal, the method comprising:

(a) providing the first optical signal from a first input port;

(b) providing the second optical signal from a second input port; and

(c) reflecting the first optical signal off a primary mirror that is configured for linear actuation along a primary axis to a plurality of primary mirror positions,

wherein in a first of such primary mirror positions the primary mirror is disposed such that the first optical signal follows a first optical path a first of a plurality of output ports and the second optical signal follows a second optical path to a second of the plurality of output ports, and

wherein in a second of such primary mirror positions the primary mirror is disposed such that the first optical signal follows a third optical path to the second output port and the second optical signal follows a fourth optical path to the first

disposed parallel to the primary axis.

46. The method according to claim 45 wherein the primary mirror is reflective on two sides.

47 . The method according to claim 46,

wherein the first optical path includes a reflection off a first reflective side of the primary mirror, two reflections off a first fixed reflective surface, and a reflection off a second fixed reflective surface,

wherein the second optical path includes a reflection off a second reflective side of the primary mirror and a reflection off the second fixed reflective surface,

wherein the third optical path includes a reflection off the first fixed reflective surface and a reflection off the second fixed reflective surface, and

wherein the fourth optical path includes a reflection off the first fixed reflective surface and a reflection off the second fixed reflective surface.

48. The method according to claim 45 further comprising:

(d) reflecting at least one of the first optical signal and the second optical signal off a secondary mirror that is configured for linear actuation along a secondary axis to a plurality of secondary mirror positions; and

(e) reflecting at least one of the first optical signal ond the second optical signal off a tertiary mirror that is configured for linear actuation along a tertiary axis to a plurality of tertiary mirror positions,

wherein in the first primary mirror position, the secondary mirror is disposed at a predetermined first secondary mirror position and the tertiary mirror is disposed at a predetermined first tertiary mirror position, and

wherein in the second primary mirror position, the secondary mirror is disposed at a predetermined second secondary mirror position and the tertiary mirror is disposed at a predetermined second tertiary mirror position.

49. The method according to claim 48 wherein the secondary mirror is [illegible] mirror is disposed parallel to the

50. The method according to claim 49,

wherein the first optical path includes a reflection off a first fixed reflective surface and a reflection off the tertiary mirror,

wherein the second optical path includes a reflection off the first fixed reflective surface and a reflection off a second fixed reflective surface,

wherein the third optical path includes a reflection off the primary mirror and a reflection off the tertiary mirror, and

wherein the fourth optical path includes a reflection off the first fixed reflective surface and a reflection off the secondary mirror.

51. The method according to claim 48 wherein the secondary mirror is disposed perpendicular to the secondary axis.

52. The method according to claim 51 wherein the tertiary mirror is disposed perpendicular to the tertiary axis.

53. The method according to claim 52,

wherein the first optical path includes a reflection off the tertiary mirror and a reflection off the primary mirror,

wherein the second optical path includes a reflection off the secondary mirror and a reflection off a fixed reflective surface,

wherein the third optical path includes a reflection off the tertiary mirror and reflection off the primary mirror, and

wherein the fourth optical path includes a reflection off the secondary mirror and a reflection off the fixed reflective surface.

54. The method according to claim 44 wherein the primary mirror is disposed at an angle between 40° and 50° to the primary axis.

55. A wavelength router for receiving, at an input port, light having a plurality of spectral bands and directing subsets of the spectral bands to respective ones of a plurality of output ports, the wavelength router comprising:

(a) a free-space optical train disposed between the input port and the output ports providing optical paths for routing the spectral bands, the optical train including a

spectral band, each such optical routing mechanism including:

(i) a mirror; and

(ii) a linear actuator disposed to move the mirror along an axis to a plurality of mirror positions,

wherein each given spectral band is directed to different output ports depending on the position of the linear actuator.

56. The wavelength router according to claim 55 wherein the dispersive element is a grating.

57. The wavelength router according to claim 56 wherein the optical train includes focussing power incorporated into the grating.

58. The wavelength router according to claim 56 wherein the grating is a reflective grating.

59. The wavelength router according to claim 56 wherein the grating is a transmissive grating.

60. The wavelength router according to claim 55 wherein the mirror is disposed perpendicular to the axis.

61. The wavelength router according to claim 55 wherein the mirror is disposed parallel to the axis.

62. The wavelength router according to claim 55 wherein each optical routing mechanism is configured such that in a first position of the linear actuator, a first of the plurality of spectral bands is directed to a first of the plurality of output ports and a second of the plurality of spectral bands is directed to a second of the plurality of output ports, and in a second position of the linear actuator, the first spectral band is directed to the second output port and the second spectral band is directed to the first output port.

63. The wavelength router according to claim 62 wherein the mirror is reflective on two sides.

64. The wavelength router according to claim 62 wherein each optical routing mechanism further includes:

second axis to a plurality of second mirror positions; and

(vi) a third linear actuator disposed to move the third mirror along a third axis to a plurality of third mirror positions.

65. The wavelength router according to claim 64 wherein at least one of the first, second, and third linear actuators comprises a bore through which one of the spectral bands is directed.

66. The wavelength router according to claim 64 wherein at least one of the first, second, and third linear actuators comprises an antireflective region transparent to a wavelength of one of the spectral bands and through which such one of the spectral bands is directed.